Nitrate of Soda

It's Origin

COMPARATIVELY few of us, except those who are interested scientifically or commercially, have any knowledge of the Chilian nitrate industry. Fewer still have any idea of the origin of the mineral "caliche," from which nitrate of soda is extracted; and yet the product is an almost indispensable commodity in agriculture and in many branches of commerce. It is only when we learn to what an extent it is used, more especially as a fertilizer and in the manufacture of explosives and glass, that we realize what an important factor it is to the world at large.

At present the entire supply of nitrate of soda comes from Chili, and, as far as is known, there are no other deposits elsewhere, or at least none which can be profitably dealt with.

This will be more readily understood when we become aware of the fact that nitrate of soda is very soluble, and that the raw material, or caliche, even draws water from the atmosphere and is dissolved. It can only be found accumulated, therefore, in rainless localities, and as only traces have ever been discovered in any of the deserts at present explored, it is only reasonable to suppose that no other such deposits are in existence.

The caliche deposits in Clili lie between the coast range and the Cordilleras or Andes, at a height of from 3,000 to 5,000 feet above sea level, in a rainless desert absolutely devoid of vegetation, and the question naturally arises as to how they could have originated.

Among the many more or less conflicting opinions, the one that has been longest accepted appears to be that these vast beds of salts were created by the evaporation of sea water in basins, which in prehistoric times formed inland seas, eventually cut off from the sea by volcanic eruptions; and that the mineral deposit originated from decayed vegetation (seaweed) and animal matter (fish, etc.), the nitrogen of which, by a process of nitrification, has been left in combination with the soda derived from the salts of the sea. This theory is strengthened by the fact that skeletons of animals, birds and fishes, together with guano, are often found under the caliche, and also that iodine is almost invariably present. We know that sea plants contain iodine—often to a large extent—but we do not know of any animal bodies or excrements which contain it; so that the mere fact of the caliche being rich in iodine gives ground for supposing that sea plants, in their decomposed state, had a large share in the formation of the nitrate beds. It is difficult, however, on this hypothesis, to account for the absence of bromide. A later theory which is influentially supported is that the deposits are largely the residue of accumulated land drainage brought down through ages from the high lands lying behind the coast.

The next step is to consider the conditions under which the caliche is extracted or mined; for it must be clearly understood that this is not a mere "surface proposition."

Speaking generally, the surface for a depth of some inches is covered with a

layer of fine loose sand, and under this sand is found a layer of certain mineral matter cemented into a compact mass, varying in thickness from one to several feet. This is called the "costra" or crust.

Below this layer is often found another layer known as "congelo," which, as its name implies, is a congested mass of sand, salt and stones with traces of nitrate.

Finally is found the caliche, and we can therefore realize that the expression "mining" may well be used in connection with the obtaining of the raw material.

The first operation, for the purpose of getting out the caliche, is to remove the various layers of soil and matter described above, and this is done by blasting. A hole or small shaft is bored from the surface right through to the natural bed on which the caliche rests, this shaft being then continued below the material to be blown up, and a space scooped out at the bottom. A charge of powder is then well packed into this chamber and the blast hole filled up with loose sand, etc., and then the powder is exploded by means of a fuse. This powder is manufactured at the oficinas, or factories, from the nitrate obtained there. The blasting over, the caliche is picked out and broken up into blocks of a convenient size, and transported either by rail or mule cart to the oficina.

Extracting the Nitrate of Soda

We now come to the extraction of the nitrate of soda from the caliche, and the first process is the crushing. This is performed by machinery, by which the caliche is crushed and dropped into cars, which in their turn carry it on to the boiling tanks. These boiling tanks are heated by means of steam pipes and serve to dissolve all the soluble components of the caliche, separating the foreign salts from the solution later on by means of crystallization.

The hot solution flows through canals to iron crystallizing pans of varying sizes, and the liquid which is left after the crystallization is drawn off and pumped up to the iodine house and the iodine extracted therefrom, after which it returns to the boiling tanks and is subsequently used in the evaporation of nitrate. When this mother liquor has run off the crystallized nitrate goes through various drying processes for some four or five days, and finally comes into the cancha, or drying floor, where it remains until it is sufficiently dry for packing in bags, containing about 200 pounds, and it is then conveyed by rail to the coast and exported.

Having discussed the supposed origin of the deposits and described shortly the method of the extraction and manufacture of nitrate of soda, it may be as well to give some idea of the estimated length of life of the nitrate grounds.

In view of the various conflicting rumors on the subject, Señor Alejandro Bertrand, civil and mining engineer, formerly Director of Public Works in Chili, and now the Chilian Government's inspector of nitrate propaganda in Europe, made an exhaustive official report to his government in June, 1908.

The greatest pains were taken in the compilation of this report, and there can be little doubt, after a careful perusal of it, that we may rely on a *minimum*

stock of some 220,000,000 tons at the present time. Moreover, as large districts in the nitrate region have not yet been explored, it is probable that the fields known to this day are only a part of those existing in Chili, and it is therefore certain that these figures will be very largely added to.

Again, no account is taken of the many millions of tons of ripio or dumps accumulated at the various oficinas, the greater part of which will undoubtedly be worked at a profit in the future, so that we must not consider only the 220,000,000 of tons in estimating the life of the fields. The exports for 1908 amounted to over 2,000,000 tons, and allowing for a moderate increase each year it will be safe to estimate a life of 100 years at least for those fields already explored—a most conservative estimate indeed, seeing that this term may well be indefinitely increased by the discovery of new beds in the hitherto unexplored portion of the nitrate region, and by the ultimate working of the enormous quantity of low-grade stuff already referred to.

The value of this industry to the Chilian Government can be readily imagined when we consider that an export duty is paid amounting to, roughly, $12.50 per ton. The annual revenue to the government from this source amounts to upward of $25,000,000.